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CONCEPTUAL VERIFICATION OF A TWIN FLUIDIZED-BED REACTOR FOR OIL SHALE RETORT/COMBUSTION

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ABSTRACT

Fluidization technology, owing to its inherent ability of vigorous solid mixing has widely been applied in industry for various applications such as surface coating, blending, gasification and combustion of coals. During the past decades oil shale retorting employing fluidized-bed process has also been investigated; however, retorting processes using fluidization technology have not yet been demonstrated on a large scale of operation. Review of current literature on oil shale retorting using fluidized-bed technology revealed that directed-heated type processes result in the loss of residual carbon in spent shale. The indirected-heated type process, on the other hand, required separated reactors to isolate the retort and combustion process; as a consequence, higher capital investment and loss of thermal efficiency became inevitable.

A novel concept which combines both the retorting and combustion process in a single reactor is presented in this paper. In this new concept, the reactor is separated in two side-by-side twin compartments; one for fresh raw shale retorting and the other for spent shale combustion. In view of the close proximity of the two beds, thermal efficiency of the twin fluidized-bed is expected to be considerably higher than the conventional technology, and simple and compact facilities can be contemplated. A 9-inch diameter twin fluidized-bed oil shale retort/combustion reactor was designed, constructed, and operated based on the data generated from a 6-inch by 7-inch cold model. Experiments using low-grade Colorado oil shale were conducted in the twin-bed. Experimental data obtained from a series of tests at various operating conditions are presented. Preliminary results from these data demonstrate successfully the feasibility of the twin fluidized-bed concept.